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Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

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INVESTIGATION REPORT INTO THE CIRCUMSTANCES ATTENDING A BREAKDOWN OF THE PROPELLING MACHINERY ABOARD THE CANADIAN VESSEL "PATERSON" IN THE PORT OF MONTREAL, QUEBEC, ON SEPTEMBER 17, 1985

REPORT No. 452

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INVESTIGATION REPORT INTO THE CIRCUMSTANCES ATTENDING A BREAKDOWN OF THE PROPELLING MACHINERY ABOARD THE CANADIAN VESSEL "PATERSON" IN THE PORT OF MONTREAL, QUEBEC, ON SEPTEMBER 17, 1985.

Particulars of Vessel

Name	"PATERSON"
Official Number	800816
Port of Registry	Thunder Bay, Ontario
Flag	Canadian
Call Sign	VOGX
Gross Tonnage	20,370
Net Tonnage	14,534
Length (registered)	221.071 m
Breadth	23.165 m
Depth	11.796 m
Draught (at time of incident)	F : 3.505 m A : 5,486 m
Type	Bulk carrier
Built	1985, steel construction at Collingwood, Ontario
Propulsion	one 4SCSATA MAK 6 cylinder, diesel engine of 8,043 b.h.p. (6,000 kW) driving a controllable pitch propeller
Bow Thruster	1,000 b.h.p.
Crew	23
Owner	N.M. Paterson & Sons Ltd. Thunder Bay, Ontario
Local Agent	Paterson NM & Fils (Quebec) Ltée Montreal, Quebec

Navigating Equipment

Radar	two (2)
Echo Sounder	one (1)
Loran C	one (1)
VHF	three (3) radios (very high frequency)
Gyro Compass	two (2)
Autopilot	one (1)
Anemometer	one (1)
Course Recorder	one (1)

Description of Vessel

The "PATERSON" is a modern Great Lakes bulk carrier. The navigation bridge, the accommodation and the engine-room are located aft. Eighteen (18) hatches can be found forward giving access to four (4) holds. The vessel was launched on April 18, 1985, at Collingwood, Ontario. The launching of this vessel introduced certain innovations such as: a more hydrodynamic hull shape, a main diesel engine burning a heavier grade of fuel which is less expensive, and an increase in the vessel's length by 2 m beyond the maximum allowable hull length accepted in the St. Lawrence Seaway. The increase of the vessel's carrying capacity was made possible by lengthening the submerged section of the hull which protrudes below the lock arrester wire.

Certificate of Vessel

The vessel was granted an Inspection Certificate for an Inland Steamship, Class I, form S.I.C. 19, on June 27, 1985, and valid to December 27, 1985.

NOTE: All times in this report are expressed in Eastern Daylight Saving Time (UTC* minus 4 hours)

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*UTC - Co-ordinated Universal Time.

Background

At about 2015 on September 17, 1985, the Canadian bulk carrier "PATERSON" departed in ballast from grain elevator No. 4 in the Port of Montreal bound for Quebec City.

Some 20 minutes later a small crankcase explosion was assumed to have occurred and the main engine was immediately stopped. The vessel drifted with the current until she was anchored off Longue Pointe.

On the following day, the "PATERSON" was towed to section 44 in the Port of Montreal where she underwent repairs. She resumed service at about 1810 on September 21, 1985.

There were no injuries and no pollution as a result of this incident.

Narrative

At about 2015 on September 17, 1985, the Canadian vessel "PATERSON" set sail from elevator No. 4 in the Port of Montreal initiating her eighth voyage since entering into service after being launched in April, 1985. She was bound for the Port of Quebec in ballast.

A few minutes later, the vessel was underway. The main engine, an 'MAK' 6 cylinder diesel of 6,000 kW (8,043 b.h.p.), was operating at about 60% of its total output. In the engine-room, the lubricating oil pressure was observed to be a little lower than normal. The assistance of other engineers was requested for the purpose of determining the reason for the drop in pressure. In order to temporarily rectify the problem, the spare electrical lube oil pump was put into operation. Two pumps were now feeding the lube oil to the main engine. The pressure immediately returned to normal.

The engineer on watch was in the control room when he heard a loud noise and saw white smoke coming out of the motor. He immediately stopped the main engine. There were no injuries and no apparent damage.

Since it was believed that the noise and smoke had been caused by a crankcase explosion, no attempt was made to restart the main engine.

On the bridge, the main engine was logged as having stopped at 2035. Whilst the master waited for a good place

to let go the anchor, the vessel continued to proceed downriver with the current. Finally at about 2055, the vessel was anchored off Longue Pointe in position 45°36'N and 073°30'W.

At about 1620 on September 18, 1985, the "PATERSON" was towed to section 44 in the Port of Montreal for the purpose of carrying out repairs to the main engine.

An inspection of the engine was made on September 18 and 19, 1985, by a Ship Safety Surveyor of the Canadian Coast Guard and by representatives of the manufacturer.

The lube oil pipe to the No. 2 main bearing was found to be broken, and the cylinder liner and piston from No. 2 cylinder were found to be beyond repair and had to be replaced.

The main bearing, connecting rod bearings, crankshaft and other main engine components were not damaged.

Repairs were made under the supervision of the manufacturer's representatives and to the satisfaction of the Ship Safety Surveyor. At about 1810 on September 21, 1985, the "PATERSON" set sail and resumed service.

Analysis

1. At the time of the incident, the weather was clear, visibility 10 miles, winds south at about 5 knots and the air temperature was about 14°C.

2. The main engine of the "PATERSON" consumes a heavy grade of fuel that has a 'flash-point'* of about 90°C. There is no need to switch to a lighter grade of fuel for manoeuvring as is commonly done on older engine models.

3. After, inspecting the main engine, all parties present came to the conclusion that no crankcase explosion occurred as such, but rather that an expansion of gas occurred in the crankcase which was caused by a severely damaged piston and cylinder liner.

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*Flash-point : The temperature to which the fuel must be brought under normal atmospheric pressure such that vapours give off or will form an explosive mixture in the air in the presence of a source of ignition.

4. An examination of the propelling machinery revealed that the No. 2 main bearing lube oil pipe was broken close to the flange which connects it to the bearing. As a result of this breakdown, No. 2 cylinder did not receive any lubrication and the piston was also deprived of its cooling agent.

   In this engine, the lubrication oil is fed under pressure to the main bearings via ducts inside the crankshaft, the connecting rod bearings and the connecting rods themselves. It cools pistons and cylinder liners before returning to the crankcase.

   Therefore it follows that once the No. 2 bearing lube oil pipe was ruptured, the oil could not reach the piston and the cylinder liner.

5. The No. 2 main bearing lube oil pipe was broken near the flange that connects it to the bearing cover. The two parts were about 2 cm apart. This copper pipe is thick and rigid and has a 30 mm diametre.

   The fractured lube oil pipe was sent to the manufacturer of the main engine for survey. From their research, they discovered the presence of pores in the weld metal between the pipe and the flange. These pores were located in the same area as the origin of the crack which caused the fracturing of the pipe. However, an inspection of two other lube oil pipes from another engine has revealed that there were pores in the weld metal but that the pipe itself did not show any signs of metal fatigue. The results of this survey tend to show that the fracture is a one of a kind and has been caused by a succession of occurrences.

6. All other main bearing lube oil pipes were examined and one of them was replaced as a precautionary measure.

7. All verification and repair work was carried out under the supervision of the 'MAK' manufacturer's representatives.

8. The "PATERSON" was launched in April 1985. She made her maiden voyage towards the end of June, about two and a half months before the breakdown. No important work had been performed on the damaged unit since it was brought into service.

9. The engineer on watch did not hold a Canadian Motor Certificate as required by section 110 (2) of the Canada Shipping Act which reads in part:

> ... every steamship to which this section applies shall be provided with such number of engineers, duly certificated, as will ensure reasonable periods of watch, having due regard to the length of any voyage, and other related circumstances, and any such additional engineer may be a fourth class engineer, duly certificated, ...

10. Section 134 (1) of the Canada Shipping Act stipulates in part:

> The Minister may, if he thinks fit, and upon such conditions, if any, as he thinks proper to impose, exempt any ship from any requirement contained in sections 109, 110, 132 and 133, ...

The vessel had no exemption aboard allowing the engineer on watch to act in that capacity.

11. The master holds a Canadian Master's Inland Waters certificate of competency issued in 1958. He took command of the "PATERSON" at the time of her launching.

The relieving chief engineer holds a British First Class Steam and Motor certificate of competency issued in 1972. He had been on board for about six (6) weeks.

The engineer on watch holds a Canadian Third Class Steam certificate.

Findings

Shortly after leaving elevator No. 4 in the Port of Montreal, a small explosion or expansion of gas occurred in the crankcase of the main engine of the "PATERSON". White smoke escaped from the crankcase explosion doors. The engineer on watch immediately stopped the engine. An inspection revealed that No. 2 piston and its cylinder liner were severely damaged.

It would appear that the following factors contributed to the breakdown of the propelling plant:

- a lube oil pipe feeding the No. 2 unit (main bearing, connecting rod bearing, piston and cylinder liner) was fractured;

- following the rupture of the lube oil pipe, the No. 2 piston and cylinder liner were considerably damaged due to a lack of lubrication and cooling agent;

- following this damage, a serious leak of combustion gas occured through the piston ring which produced a sudden expansion of gas in the engine crankcase;

- a careful examination of the engine revealed no other defective components except for one other lube oil pipe which was replaced as a precautionary measure; and

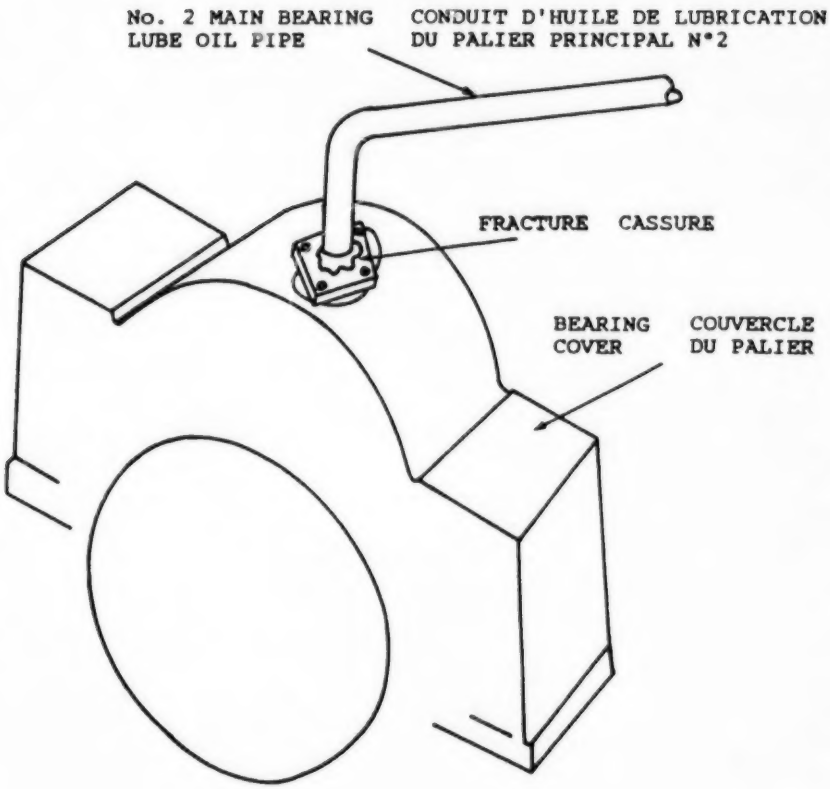
- the cause of this mechanical breakdown is not related to a design fault, but rather to a warping or to a construction flaw in the lube oil pipe which led to a fatigue fracture.

Other Findings

The vessel was in contravention of section 110 (2) of the Canada Shipping Act in that she did not have an exemption issued pursuant to section 134 (1) of the same Act.

OTTAWA, ONTARIO
DECEMBER, 1986.

"PATERSON"



No. 2 MAIN BEARING PALIER PRINCIPAL N°2